

Claims

1. A magnetic holding device including:
  - a) a support structure made of an iron alloy and having a substantially planar bearing surface;
  - 5 b) at least one magnetic or magnetisable region located in said support member; and
  - c) insulating means made of non-magnetic material interposed between said region and said support structure to resist magnetic induction of, or leakage to, said support structure.
- 10 2. A magnetic holding device according to claim 1, wherein the device is in the form of a plate, having two opposed planar surfaces.
3. A magnetic holding device according to either claim 1 claim 2, wherein the device is rectangular.
4. A magnetic holding device according to any one of the previous claims, wherein 15 the device is used as a spacer plate in graphic art design processes and the magnetic holding device is between about 4mm and 6.5mm thick.
5. A magnetic holding device according to any one of the previous claims, wherein the bearing surface of the spacer plate includes sizes of about 210 x 150mm (A5 size), 300 x 210mm (A4 size) or 420 x 300mm (A3 size).
- 20 6. A magnetic holding device according to any one of the previous claims, wherein the support structure includes one or more bores adapted to receive the one or more magnetic or magnetisable regions.
7. A magnetic holding device according to any one of the previous claims, wherein 25 the support structure is made of steel, including mild steel, case-hardened steel, stainless steel and the like.

8. A magnetic holding device according to any one of the previous claims, wherein the at least one magnetic or magnetisable region includes a magnetisable core subject to an electric field to induce magnetism or is in the form of a permanent magnet.
9. A magnetic holding device according to any one of the previous claims, wherein 5 the magnetic holding device includes a plurality of magnetic or magnetisable regions in spaced relationship with one another.
10. A magnetic holding device according to any one of the previous claims, wherein the one or more magnetic or magnetisable regions have a diameter of 2-10mm.
11. A magnetic holding device according to claim 10, wherein the at least one 10 magnetic region has a diameter of 3-6mm.
12. A magnetic holding device according to any one of the previous claims, wherein the at least one magnetic region has a substantially cylindrical shape.
13. A magnetic holding device according to claim 12, wherein the at least one magnetic region has an axial length less than the thickness of the support structure.
- 15 14. A magnetic holding device according to any one of the previous claims, wherein the, the bore in which the magnetic region resides is in the shape of a cup, channel or block.
15. A magnetic holding device according to any one of claims 1 to 13, wherein the bore in which the magnetic region resides is cylindrical.
- 20 16. A magnetic holding device according to any one of the previous claims, wherein the device the distance separating the adjacent magnetic regions falls within the range of 5-25mm.
17. A magnetic holding device according to claim 16, wherein the distance is 6-8mm.
18. A magnetic holding device according to any one of the previous claims, wherein 25 the plurality of magnetic regions is orientated so that the north poles are co-planar.

19. A magnetic holding device according to any one of claims 1 to 17, wherein the magnetic regions are grouped so that members within each group share the same pole in a common plane but have opposite poles to each adjacent group.
20. A magnetic holding device according to any one of the previous claims, wherein adjacent magnetic regions have opposite poles whereby to maximise the magnetic field intensity of any particular point on the bearing surface of the magnetic holding device.
21. A magnetic holding device according to any one of the previous claims, wherein the insulating means is made from a wide range of non-magnetic materials effective to insulate the support structure against direct magnetic leakage.
- 10 22. A magnetic holding device according to any one of the previous claims, wherein the magnetic regions include a magnetic surface which lies close to or flush with the planar bearing surface.
23. A magnetic holding device according to any one of claims 1 to 21, wherein the magnetic surface lies flush with the planar bearing surface to maximise the magnetic force applied to a work piece, such as a steel backed die.
- 15 24. A magnetic holding device according to any one of claims 1 to 21, wherein the magnetic surface lies just beneath the plane of the planar bearing surface to reduce the incidence of fatigue in the magnetic regions which may be sustained during a graphic art design process.
- 20 25. A magnetic holding device according to any one of the previous claims, wherein the insulating means is made of any suitable non-magnetic material, for example, non-magnetic metals such as copper, brass, zinc or aluminium, copper alloys, aluminium alloys, magnesium alloys, nickel, titanium, or from other materials including polymeric materials including tempered glass fibre, metal fibre, carbon fibre or graphite fibre.
- 25 26. A magnetic holding device according to any one of the previous claims, wherein the polymeric material includes a thermoset resin selected from the group including allyl polymers, epoxy polymers, furan, melamine formaldehyde, melamine phenolic polymers, phenolic polymers, polybutyldiene polymers, thermoset polyester and alkyd polymers,

thermoset polyamide polymers, thermoset polyurethane polymers, flexible thermoset silicone polymers, silicone epoxy polymers and thermoset ureapolymers.

27. A magnetic holding device according to any one of claims 1 to 25, wherein the insulating means is copper alloy.
- 5 28. A magnetic holding device according to any one of the previous claims, wherein the insulating means is in the form of a tube where the magnetic region extends from one face of the support structure through to its opposite face or in the form of a cup where the bore in which the region resides does not extend entirely through the support structure.
- 10 29. A magnetic holding device according to any one of the previous claims, wherein the magnetic holding device is nickel plated, to provide resistance against rusting and scratching, due to the superior characteristics of nickel.
30. A magnetic holding device according to any one of the previous claims, wherein to enhance and improve heat conductivity, additional solid copper or brass rods are utilised in addition to insulated magnetic regions.
- 15 31. A magnetic holding device according to any one of the previous claims, wherein the magnetic device for a hot foil stamping press employing a cylinder, is provide with engagement means to assist retention in the press.
32. A method of manufacturing a magnetic holding device including at least one magnetic body located in a support structure, said method including the steps of:
  - 20 a) forming at least one bore in said support structure, said support member being made from a hard iron alloy and having a substantially planar bearing surface;
  - b) inserting insulating means made from non-magnetic material into said bore, said insulating means defining a hole substantially coaxial with said bore; and
  - c) inserting the magnetic body into said hole,

wherein said insulating means is interposed between said magnetic body and said support structure to resist magnetic induction of, or leakage to, said support structure.

33. A method of manufacturing a magnetic holding device including at least one magnetic body located in a support structure, said method including the steps of:

- 5 a) forming at least one bore in said support structure, said support structure being made from an iron alloy and having a substantially planar bearing surface;
- b) inserting said body into insulating means to form an insulated body having an internal magnetic core surrounded by non-magnetic insulating means; and
- c) inserting said insulated body into said bore, wherein said insulating means is 10 interposed between said internal core and said support structure to resist magnetic induction of, or leakage to, said support structure.

34. A method of manufacturing a magnetic holding device according to either claim 32 or claim 33, wherein the bore may be formed in the support structure by any one of a range of means familiar to the person skilled in the art.

15 35 A method of manufacturing a magnetic holding device according to claim 34, wherein the bore is formed by machining the support structure and the bore may extends entirely through the support structure or may extend part way through to form a recess.

36. A method of manufacturing a magnetic holding device according to claim 35, wherein the bore is any suitable shape or configuration such as block, square, rectangular 20 or triangular shaped.

37. A method of manufacturing a magnetic holding device according to claim 34 wherein, the magnetic body is preferably cylindrical or disc-shaped, and the bore is correspondingly cylindrical or cup shaped.

38. A method of manufacturing a magnetic holding device according to claim 32 or 25 claim 33, wherein the magnetic body is inserted into the insulating means using correspondingly threaded or otherwise grooved means to mutually engage.

39. A method of manufacturing a magnetic holding device according to claim 38 wherein, the magnetic body is press fitted into the insulating means.
40. A method of manufacturing a magnetic holding device according to claim 38 wherein, the magnetic body is bonded into the insulating means by utilising an adhesive or 5 other chemical compound.
41. A method of manufacturing a magnetic holding device according to either claim 32 or claim 33, wherein the insulated body is press fitted into the bore, relying on the malleability of the insulating means to ensure a tight fit.
42. A method of manufacturing a magnetic holding device according to claim 41 10 wherein, the retention of the insulated body in the bore is improved by utilising adhesive or other chemical means.
43. A method of manufacturing a magnetic holding device according to claim 32 or claim 33, wherein the wall thickness of the insulating means is between 10µm and 3mm.
44. A method of manufacturing a magnetic holding device according to either claim 32 15 or claim 33, wherein the outer wall of the insulating material is provided with a step or steps to help prevent the insulated magnetic core from being prematurely ejected from the magnetic plate under pressure from constant use.
45. A method of manufacturing a magnetic holding device according to either claim 33 or claim 34 wherein, the bearing surface of the magnetic holding device is substantially 20 smooth and planar.
46. A method of manufacturing a magnetic holding device according claim 45 wherein, the planar bearing surface is ground using a grinding machine to render the bearing surface substantially planar.
47. A method of manufacturing a magnetic holding device according claim 46 wherein, 25 the underside of the magnetic holding device is also ground to ensure a uniformly flat surface thereunder as well.

48. A metal conductor including:

- a support structure made of an iron alloy;
- a first region made of a relatively poor thermal and electrical conducting metal located in said support structure; and

5 a second region made of a relatively good thermal and electrical conducting metal surrounding the first region from the support structure, whereby the rate of thermal and electrical conductivity of the metal conductor as a whole is better than the rate of the thermal or electrical conductivity of the second region material alone.

49. A metal conductor according to claim 48 wherein the support structure is

10 cylindrical, corrugated, regular, spherical, block-shaped or planar.

50. A metal conductor according to claim 49, in the case of a hot foil stamping process, where the support structure is predominantly planar or cylindrically shaped.

51. A metal conductor according to any one of claims 48 to 50, in which the support structure is made of steel, including mild steel, case-hardened steel, stainless steel, or

15 carbon-steel.

52. A metal conductor according to any one of claims 48 to 51 wherein the second region is made from a variety of good thermal and/or electrical conducting materials, including copper, nickel, silver, gold, aluminium, zinc, magnesium, titanium, or a combination of two or more of the aforementioned, which is be used to form alloys such as

20 copper alloys including brass, aluminium alloys and magnesium alloys.

53. A metal conductor including:

- a support structure made of an iron alloy;
- a first magnetic or magnetisable region located in the support structure;
- a second region made of a relatively good thermal and electrical conducting metal

25 surrounding the first region,

whereby the rate of thermal and electrical conductivity of the metal conductor as a whole is better than the rate of thermal or electrical conductivity of the second region material alone.

54. A metal conductor according to claim 53 in which the poor conducting metal of the first region includes metal alloys comprising a large proportion of iron and other elemental components similarly possessing poor heat and/or electrical conducting properties, including samarium cobalt (SmCo<sup>17</sup>) having a magnetic flux of 16-32 MGOe (Mega Gauss Orsted) and neodymium-iron-boron (NdFeB) with an MGOe of 24-48.
55. A metal conductor according to claim 53 or claim 54, in which the first region comprises a plurality of separate regions forming islands each surrounded by a second region and set in the support structure.
56. A metal conductor according to claim 55, wherein the first regions are irregularly or randomly scattered throughout the surface of the support structure.
57. A metal conductor according to claim 55, in which the first region comprises a regular array of islands.
58. A metal conductor according to any one of claims 49 to 57, in which the first region is made from ferromagnetic material and is in the form of a plurality of discreet solid cylinders or plugs arranged in a regular array flush with the surface of the support structure.
- 20 59. A metal conductor according to claim 58, wherin the plugs extend from one external surface of the support structure to an opposed external surface.
60. A magnetic holding device including:
  - a) a support structure made of an iron alloy including one or more recesses and having a bearing surface;
  - 25 b) at least one magnetic or magnetisable region located in said recess of said support structure; and

c) insulating means made of non-magnetic material interposed between said region and said support structure to resist magnetic induction of, or leakage to, said support structure from said region.

61. A magnetic holder device according to claim 60, in which the bearing surface is in 5 the form of a planar, cylindrical or otherwise curved surface.

62. A metal conductor including:

a support structure made of an iron alloy;

first poor conducting regions made of metal located in said support structure;

10 second good conducting regions, each second good conducting region made of metal which surrounds one of the first regions from the support structure; and

a third good conducting region intermediate at least two of the second good conducting regions,

15 whereby the rate of thermal and electrical conductivity of the metal conductor as a whole is better than the rate of the thermal and electrical conductivity of the material of the second or third good conducting regions alone.

63. A metal conductor according to claim 62, in which the third good conducting region is preferably isolated from the second good conducting regions.

64. A metal conductor according to claim 63, wherein the third region is preferably embedded in the support structure.

20 65. A metal conductor according to any one of claims 61 to 64 in which the third region is fixedly seated or inserted in a bore in the support structure.

66. A metal conductor according to claim 65, in which the first, second and third regions are arranged in a regular array, including equidistant relative to adjacent second regions.

66. A metal conductor according to any one of claims 61 to 66 in which the third region includes a plurality of islands intermediate the second regions.

67. A metal conductor according to claim 66, in which the islands are rod-like, plate-like, cylindrical, conical, truncated conical, square or rectangular box-like, or 5 cylindrical.

68. A metal conductor according to claim 66 or claim 67, in which the islands are made from any non-ferrous metal or metal alloy such as copper or brass or any material of which the second region may be made.

69. A metal conductor according to any one of claims 61 to 68 wherein it is formed 10 from sub-units.

Two or more individual metal conductors may be combined to present a larger unitary top bearing surface, the sum of the individual sub-units. Where the metal conductors are plates, the plates may be abutted side by side to present a substantially seamless top bearing surface. At least one peripheral edge of each sub-unit may include alignment 15 means to ensure the correct alignment of the sub-units and, optionally, the engagement of one sub-unit to an adjacent sub-unit. The alignment means may include male or female components, such as a male components on a first sub-unit and a female component on a second sub-unit. The alignment means may include tongue and groove, a pin and hole, rail and slot arrangements or any other suitable protrusion and recess combination. The 20 sub-units preferably exhibit little lateral magnetic attraction or repulsion to enable easy coaction of one sub-unit with another.

70. A method for aligning a die having a top peripheral surface adjacent a relief surface to a magnetic holding device as described herein having a bearing surface in a graphic art design process including:

25           a)       aligning said magnetic holding device on a ferrous metal support;  
              b)       aligning said die on said magnetic holding device; and

c) securing said die to said magnetic holding device by applying to said top peripheral surface and to said bearing surface a length of single sided adhesive tape,

wherein the adhesive is sufficiently strong to ensure that said die remains in position during  
5 said graphic art design process.

71. The die may include a range of configurations and materials which are in common use in the industry. The die may include brass, copper, magnesium, aluminium, zinc, or polymeric (or composites thereof), optionally 0.5mm to 2mm or 1/32 to 1/16 inch thick with the relief surface standing proud above the line of the remaining top surface of the  
10 die. Such dimensions are suitable for use in the present inventive method.

72. The top peripheral surface may extend only along one edge of the die. Preferably, however the top peripheral surface extends around the entire top surface of the die. The top peripheral surface may be recessed to permit the application of tape on its surface without rising above the line of the surface on which the relief is located ("the relief  
15 surface"). The top peripheral surface may be between 5mm and 50mm wide, preferably being about 10mm to 20mm wide. The depth of the recess would depend on the thickness of the tape being used, but as a general guide may be between 0.1mm and 2mm deep.

73. The relief surface is preferably central to the top surface of the die and is of a dimension and nature well known in the art and dependant on the nature of the graphic art  
20 to be produced.

74. The magnetic holding plate may be in accordance with the magnetic holding device described above. The magnetic holding plate provides an easily manipulable support for bearing the die, particularly when handling the die during a graphic art design process involving high temperatures. Accordingly, advantageously the magnetic holding plate has  
25 sufficient magnetic flux to stably adhere to the chase without being displaced during a production run, but is sufficiently movable by standard manual tools to achieve desired alignment of the die preparatory to a production run. To this purpose, it may be desirable in some applications to have a magnetic holding plate of smaller plan proportions whereby

to minimise the magnetic force applied by the magnetic holding plate to the chase as a whole.

75. Accordingly, in some applications it may be preferable to utilise a combination of two or more magnetic holding plates of smaller dimensions which are separately easily 5 manoeuvrable, but which may be combined to form a larger unitary bearing surface on which the die may be mounted. Accordingly, the magnetic holding plate may be formed from a plurality of sub-units.

76. The sub-units may include alignment means. The alignment means may be located along one or more peripheral edges of the sub-unit. Adjacent sub-units may include 10 complementary alignment means. The alignment means may effectively provide engagement means which may be releasable when it is required to separately manipulate and re-align or remove one or more of the sub-units from the chase. The alignment means may include male and female components. The alignment means may include tongue and groove, protrusion and hole, flange and slot, rail and recess arrangement and the like.

15 77. The peripheral edges of the sub-units may be cut to low tolerance by a high precision cutting implement, such as a wire cutter or a laser cutter, so that on abutment with an adjacent sub-unit, the top bearing surface presented to the die is virtually seamless.

78. The tape may be high temperature resistant and suitable for use in a hot foil stamping process or any other graphic art design process involving elevated temperatures. 20 The adhesive used is preferably of a type that will not cure at the operating temperatures during the process and is easily removed without leaving residue. The backing of the tape may be a polymeric film such as polyamide or polyester, glass cloth tape, crepe paper masking tape, such as smooth or mini or thicker crepe paper.

79. Polyamide backing may be used in applications requiring performance stability at 25 high temperatures. Glass cloth backing may be useful where dies are subject to some shearing forces, such as may be experienced where the stamping process involves a cylindrical drum rather than a linearly reciprocating stamping means because of the relative high tensile strength of glass cloth backing. It may also be useful at extremely high temperatures. Polyester film backing will be useful in applications involving very long

production runs due to its abrasion, chemical and thermal resistance under wide-ranging conditions.

80. The adhesive may include silicone adhesive for high temperature resistance and easy removal without leaving residue on the die or magnetic holding device.

5 81. Preferably the method for aligning the die includes the further steps of:

e) carrying out the graphic art design process; and subsequently

f) peeling the tape off the top peripheral surface and the bearing surface,

such that no adhesive residue remains on the top peripheral surface or the bearing surface and the die is not damaged by peeling of the tape in step f).

10 82. The die may be in the form of a thin wafer about 0.5mm to 1.5mm, and preferably 1.3mm or 1/16 inch in thickness.

83. The top peripheral surface may be recessed relative to the relief surface to ensure the tape does not interfere with the graphic art design process. Accordingly, the height difference between the recessed top peripheral surface and the supporting surface for the 15 relief ("the relief surface") is greater than or equal to the thickness of the tape.

84. Where the die has an original thickness greater than that desired for the graphic art design process, such as  $\frac{1}{4}$  inch or 7mm, the method for adhering the die may further include a preliminary step involving cutting the die to a thickness of substantially 1.3mm or 1/16 inch.

20 85. A magnetic holding device substantially as described herein with reference to the drawings.

86. A method for manufacturing a magnetic holding device substantially as described herein in conjunction with the drawings.